



## INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(51) International Patent Classification <sup>6</sup> : <b>A62B 18/04, 18/08</b>	<b>A1</b>	(11) International Publication Number: <b>WO 99/27999</b> (43) International Publication Date: 10 June 1999 (10.06.99)
<p>(21) International Application Number: PCT/CA98/01126</p> <p>(22) International Filing Date: 3 December 1998 (03.12.98)</p> <p>(30) Priority Data: 2,223,345 3 December 1997 (03.12.97) CA</p> <p>(71) Applicant (for all designated States except US): BOMBARDIER INC. [CA/CA]; 800 René Lévesque Boulevard West, Montreal, Quebec H3B 1Y8 (CA).</p> <p>(72) Inventors; and (75) Inventors/Applicants (for US only): KALHOK, David [CA/CA]; 329 Channel Road, Georgeville, Quebec J0B 1T0 (CA). RONDEAU, Pierre [CA/CA]; 142 des Patriotes, Bromont, Quebec J2L 2R6 (CA). AUBE, Martin [CA/CA]; 3790 Monseigneur Moisan, Sherbrooke, Quebec J1L 2C1 (CA). CADOTTE, Germain [CA/CA]; 389 des Bois Francs, St-Elie d'Orford, Quebec J0B 2S0 (CA).</p> <p>(74) Agents: GEORGIEV, Stephan, P. et al.; Smart &amp; Biggar, Suite 3400, 1000 de la Gauchetière Street West, Montreal, Quebec H3B 4W5 (CA).</p>	<p>(81) Designated States: AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, CA, CH, CN, CU, CZ, DE, DK, EE, ES, FI, GB, GE, GH, GM, HR, HU, ID, IL, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MD, MG, MK, MN, MW, MX, NO, NZ, PL, PT, RO, RU, SD, SE, SG, SI, SK, SL, TJ, TM, TR, TT, UA, UG, US, UZ, VN, YU, ZW, ARIPO patent (GH, GM, KE, LS, MW, SD, SZ, UG, ZW), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, GW, ML, MR, NE, SN, TD, TG).</p> <p><b>Published</b> With international search report.</p>	
(54) Title: BREATHING MASK FOR A HELMET		
<p>(57) Abstract</p> <p>A breathing mask for a helmet which reduces the formation of water on the lens of the eyeglasses of the wearer or on the shield of the helmet. The helmet comprises a head portion, a face portion, a see-through shield and a breathing mask. The breathing mask is hermetically adapted to the face of the wearer and the breath of the wearer is thereby restricted from the interior of the helmet by being evacuated outside the helmet through breathing channels. The breathing mask is provided with disposable filters to protect the skin of the wearer from irritation. A face portion of the helmet can be pivotally opened or closed and is locked to the head portion in the closed position. The face portion also features a tinted shield partially hidden that can be lowered inside the helmet to protect the wearer from sun rays and reflexions.</p>		

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**BREATHING MASK FOR A HELMET****5    Field of the invention**

The invention relates to a breathing mask for a helmet which is particularly well suited for use when the temperature is below a certain point i.e. the point under which the breath of an operator condenses inside the helmet and causes the  
10    advent of water on the lens of the eyeglasses of the operator or on the shield of the helmet.

**Background of the invention**

15    A prior art helmet comprises a first part which protects the head of a wearer, as a conventional helmet; a second part, which is integrated with and forms a projection with the first part and protects the lower part of the face of the wearer, more particularly the jaw; and a shield, which is situated between an upper front section of the first part and an upper section of the second part to protect the  
20    face of the wearer.

Due to its structure, the helmet has a small interior chamber where the wearer can breath. This interior chamber is usually insulated from the atmosphere to protect the wearer from cold air. At a certain temperature, air

which contains saturated particles of water will condense and create condensation. Because the temperature of the lens of the eyeglasses of the operator wearing the helmet or the shield of the helmet can reach the condensation point of the breath of the wearer, water will form on the eyeglass  
5 lens or on the shield.

In order to avoid the problem of condensation, it is possible to open the shield to allow outside air to flow into the helmet until condensation is eliminated. This however presents a problem in that the wearer may be exposed to cold air  
10 which is uncomfortable and may be dangerous to health. Furthermore, the wearer has to use one hand to open the shield which may be hazardous when he or she is steering the vehicle being driven. The shield could also involuntarily close by impact or sudden movement. Thus, there is a need to provide a device which is capable of avoiding or eliminating the condensation created inside a full  
15 face helmet.

A prior art helmet provides some protection against sun rays. However, the shield of a prior art helmet is either clear or tinted and no adjustment of the tint is possible. On a bright sunny day, the wearer of a prior art helmet must also  
20 wear tinted eyeglasses to protect himself against the intensity of light if the shield of his helmet is clear. In changing weather conditions, the wearer may have to put the tinted eyeglasses on and off as the intensity of light changes. Thus, there is also a need to provide a helmet adapted to adjust the protection of the

eyes of the wearer from sun rays.

**Objects and statement of the invention**

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It is an object of the present invention to provide a breathing mask for a helmet which reduces the formation of water on the lens of eyeglasses or the shield of the helmet.

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It is an object of the present invention to provide a helmet that overcomes or at least reduces the deficiencies associated with a prior art helmet.

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It is another object of the present invention to provide a helmet comprising a breathing mask which reduces the formation of water on the lens of eyeglasses or the shield of the helmet.

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A further object of the invention is to provide a helmet including a tinted inner shield which is adapted to adjust the protection of the eyes of the wearer from sun rays as he or she requires.

As embodied and broadly described herein, the invention provides a breathing mask adapted to fit the contours of the face of a wearer, said breathing mask

adapted to be mounted to a helmet, said breathing mask comprising at least one breathing channel through which air may circulate and a binding member; said at least one breathing channel adaptable to said helmet and said binding member adapted to connect and secure said breathing mask to said helmet, and  
5 to position said breathing mask in relation to said face.

As embodied and broadly described herein, the invention provides a helmet adapted to receive and retain a breathing mask, said helmet comprising:

- a head portion;
- 10 - a face portion mounted to said head portion, said face portion including at least one passage adapted to receive an exterior end of said breathing channel,
- a binding member adapted to secure said breathing mask to said helmet, whereby the breathing mask is substantially hermetically  
15 adapted to the face of the wearer and the breath of the wearer may be expelled from inside said face portion.

In a preferred embodiment of the present invention the novel helmet comprises  
20 a head portion adapted to protect the head of the operator, a face portion adapted to protect the forehead and the lower portion of the face of the wearer or operator; the face portion being mounted to the head portion and adapted to move from an open position to a closed position and a optional latching

mechanism which locks the face portion to the head portion. The optional latching mechanism is actuated with two lever buttons located at the front of the face portion and sufficiently close to one another so that one hand can actuate both buttons and in the same movement pull the face portion from the closed position to the open position. The face portion has passages that are connected, when the face portion is in the closed position, to a breathing mask through flexible tubes thereby linking the breathing mask to the outside through which the wearer may breath and the moisture content of his or her expelled breath can circulate and be evacuated. This arrangement prevent or at least greatly reduces condensation and fogging of the shield of the face portion and of the eyeglasses of the wearer.

The breathing mask comprises a mask body, surrounding the nose and mouth of the wearer and including a port on each side adjacent the mouth; a flexible tube which connects said port to said passage when said face portion is in the closed position, a binding member adapted to secure said breathing mask to said helmet, and resilient straps.

The binding member connects said breathing mask to the helmet, wherein said breathing mask is substantially hermetically adapted to the face of the wearer and the breath is restricted from entering the inside chamber. The binding member is preferably a snap-holder located at one end of the flexible tubes. The binding member may also be a hook and loop (velcro) device, a clip

or a strap; all these elements being capable of connecting and securing the breathing mask to the head portion of the helmet.

Advantageously, the helmet will further comprises a shield portion  
5 including a see-through shield and a tinted shield; said tinted shield being  
movable from a first position to a second position, said tinted shield adapted, in  
said first position, to be housed and partially hidden inside an upper chamber,  
and in said second position, to be in front of the eyes of the wearer whereby said  
tinted shield protects the eyes of the wearer from intense light. The tinted shield  
10 includes a lever protruding from a narrow slot of the upper chamber, this lever  
is adapted to manoeuver said tinted shield from said first position to said second  
position.

As embodied and broadly described herein, the invention also provides a filter  
15 for a breathing mask comprising a thin layer of material adapted to isolates the  
skin of a wearer from said breathing mask, said layer of material shaped to fit a  
given contour of said breathing mask.

Another object of the invention is to provide a filter adapted to be positioned  
20 between the mask body and the face of the wearer whereby said filter isolates  
the skin of the wearer from the breathing mask. Advantageously, the filter is a  
supple thin cloth of felt-like material.

As embodied and broadly described herein, the invention also provides a breathing mask kit comprising:

- a mask body adapted to fit the contours of the face of a wearer, said mask body including at least one port;
- 5       - at least one hollow flexible tube including an interior end and an exterior end;
- a binding member including an aperture; said binding member adapted to secure said breathing mask to a helmet and to align said aperture with a passage on said helmet;
- 10       - said interior end being adapted to engage said at least one port of said mask body and said exterior end being adapted to engage said aperture of said binding member whereby when said at least one hollow flexible tube is engaged to said at least one port of said mask body and to said aperture of said binding member, said at least one hollow flexible tube
- 15       acts as a conduit through which the breath of a wearer may circulate.

Other objects and features of the invention will become apparent by reference to the following description and the drawings.

20       **Brief description of the drawings**

A detailed description of the preferred embodiments of the present invention is provided herein below, by way of example only, with reference to the

accompanying drawings, in which:

Figure 1 is a perspective view of a full face helmet constructed in accordance with the invention;

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Figure 2 is a side elevational view of a full face helmet constructed in accordance with the invention;

Figure 3 is a perspective exploded view of a breathing mask constructed in accordance with the invention;

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Figure 4 is a front elevational view of the breathing mask constructed in accordance with the invention;

Figure 5 is a side elevational view of the full face helmet showing the full face helmet in an open position worn by a wearer with the breathing mask partially removed;

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Figure 6 is a side elevational view of a full face helmet in an open position worn by a wearer with the breathing mask put on;

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Figure 7 is a side elevational view of a full face helmet worn by a wearer with the face portion lowered into the closed position and the shield portion in the

open position;

Figure 8 is a front elevational view of the full face helmet constructed in accordance with the invention;

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Figure 9 is a side elevational view of the shield portion removed from the full face helmet; and

Figure 10 is side elevational view of the full face helmet showing the motion of the shield portion.

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In the drawings, preferred embodiments of the invention are illustrated by way of examples. It is to be expressly understood that the description and drawings are only for the purpose of illustration and are an aid for understanding. They are not intended to be a definition of the limits of the invention.

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#### Detailed description of preferred embodiments

Referring now to the drawings, figure 1 and 2 illustrate the novel helmet which is generally designated by the reference number 10. The helmet 10 comprises a head portion 12, a face portion 14 pivotally connected to the head portion 12, pivoting about axis A, and having a pair of passages 16 through which the breath of a wearer may circulate, a see-through shield 18, an inside chamber 20, a breathing mask 22, and a pair of lever buttons 23 located at the front of the face portion 14.

With reference to figures 3 and 4, the breathing mask 22 comprises a mask body 24 preferably made of a supple material so as to embrace the contours of the face. The mask body 24 preferably features a port 26 on both sides, adjacent to the mouth of the wearer. Flexible tubes 28 are provided to  
5 connect the ports 26 to the passages 16 of the face portion 14 (fig. 1 and 2). As can be seen in fig.3, the flexible tube 28 has an interior end 30 and an exterior end 32. The interior end 30 is adapted to be engaged into port 26 and the exterior end 32 is adapted to be hermetically connected with the passage 16. The flexible tube 28 is assembled to the mask body 24 by inserting the last rib  
10 of the interior end 30 into port 26 . The exterior end 32 is inserted through the aperture 46 of the snap-holder 36 so that the exterior end 32 protrudes through the aperture 46 of snap-holder 36. The exterior end 32 is provided with an annular lip 31 in order to create an hermetic seal with the passage 16 of the face portion 14 when these two components (32 and 16) are aligned. The flexible  
15 tube 28 is also preferably made of a supple material and features an array of ribs enabling the flexible tube 28 to assume various lengths for ease of assembly and to provide freedom of movement when the breathing mask 22 is put on or taken off. The flexible tubes 28 are of course hollow to provide adequate circulation of air.

20

A filter 70 adapted to fit inside the breathing mask 22 is provided optionally to isolate the skin of the wearer from the mask body 24. The filter 70 is a supple thin layer of material like a cloth or a felt, adapted to permit airflow

while stopping dust particles. The material is preferably soft so as not to irritate the skin of the wearer. The filter 70 is positioned inside the mask body 24 before the breathing mask 22 is put on. It may be discarded after use and replaced by a new one or it may be re-used as often as one wishes. The filter 5 70 features a opening 72, for example a V-shaped opening, which facilitates the installation of the filter 70 into the mask body 24 and prevents folding of the filter 70 when positioned over the nose of the wearer. Folding of the filter 70 could allow the breath to escape into the inside chamber 20. Advantageously, the filter 70 protects the skin of the wearer from possible irritation when the 10 breathing mask 22 is worn for a extended period of time. This filter 70 also serves as an hygienic device if the full face helmet 10 is to be used by more than one person.

A frontal cover 34 is mounted to the front portion of the mask body 24 in 15 order to hold and maintain in position, a pair of resilient straps 40. The resilient straps 40 are engaged at each end, to slender apertures 48 of the snap-holders 36. The resilient straps 40 are provided to adjust the length of each flexible tubes 28 thereby adjusting the distance between the mask body 24 and the snap-holders 36. The adjustment is achieved by setting the length of the 20 resilient straps 40 using standard buckles 45. From fig. 3, it can be seen that snap-holders 36 are elongated components featuring at one end, a substantially circular aperture 46, a pair of slender apertures 48 and at the other end, a snap button 38.

Referring to fig.5, the head portion 12 comprises a pair of side covers 80 fastened to the side of the head portion 12 featuring an aperture 82 which opens onto a snap 84 on which the snap button 38 of the snap-holder 36 will be engaged. The side covers 39 features a second aperture 86 shown in dotted lines configured to receive an optional latching mechanism 90 also shown in dotted lines which locks the face portion 14 to the head portion 12 when the face portion 14 is in the closed position. The side covers 39 has a curved section 88 provided to fit the circular contour 37 of the snap-holder 36. The combination of configuration of the circular contour 37 of the snap-holders 36 and of the curved section 88 of the side covers 39 enables proper positioning of the snap-holders 36 in relation to the head portion 12, to the face portion 14 and more specifically, to the passages 16 when the face portion 14 is in the closed position. Figure 7 shows how the passage 16 and the circular aperture 46 of the snap-holders 36 are aligned when the face portion 14 is in the closed position.

To put the full face helmet 10 on with the breathing mask 22, the wearer must have the face portion 14 in the opened position. As shown in fig. 5, the wearer first attaches one of the snap-holders 36 to the head portion 12 and then puts the head portion 12 over his or her head. The filter 70 previously described may be positioned inside the mask body 24 before the breathing mask 22 is put on. Advantageously, the filter 70 protects the skin of the wearer from possible irritation when the breathing mask 22 is worn for a extended period of time.

Once the filter is positioned inside the breathing mask 22, the wearer then puts the breathing mask 22 over his mouth and nose and engages the remaining snap-holder 36 to the other side of the head portion 12 as shown in fig. 6. Fig. 6 also shows the filter 70 installed thereby isolating the skin of the wearer from the mask body 24 and preventing any direct contact between the skin and the mask body 24.

Referring to fig.7, once the breathing mask 22 is installed, the wearer can lower the face portion 14. In the fully closed position, the optional latching mechanism 90 located on both sides the face portion 14 engages the aperture 86 of the side covers 39 thereby locking the face portion 14 onto the head portion 12 and preventing the face portion 14 from unduly opening because of wind gust or from an impact at which time, it is critical that the face portion 14 remains properly position in order to efficiently protect the wearer. The locking mechanism 90 may be disengaged by simply pressing simultaneously the two lever buttons 23 located at the front of the face portion 14. The two lever buttons 23 are actuated by pressing them in the direction illustrated by the arrows in fig 8. Advantageously, the lever buttons 23 are positioned close enough to each other so that they can be actuated with a single hand. This feature is very useful at times when the wearer wishes to raise the face portion 14 while driving a vehicle. It could be dangerous to let go of the steering even for a short period of time. This feature allows him or her to keep one hand on the steering while raising the face portion 14. Moreover, once the two lever

buttons 23 are pressed and the latching mechanism 90 is disengaged, the same two lever buttons 23 serve as gripping elements enabling the hand to apply the necessary force to raise the face portion 14.

5           As shown in fig. 7, the wearer may also choose to keep the face portion 14 in the closed position and instead, raise the shield portion 52 which is pivotally mounted to the face portion 14. The shield portion 52 comprises the see-through shield 18 and two small handle grips 54 located at the bottom of the shield portion 52 which enable the wearer to take hold of the shield portion 52  
10 in order to raise it. Referring to fig. 9, the shield portion 52 advantageously features a jagged surface 55 surrounding the pivoting points which enable the shield portion 52 to be partially opened and remain in a partially opened position due to the added friction provided by the jagged surface 55.

15           Referring now to fig. 9 and 10, the shield portion 52 also advantageously comprises an upper chamber 56 in which a tinted shield 58 is housed and adapted to be raised or lowered with a lever 60 guided by a narrow slot 62 (fig.8). The tinted shield 58 is pivotally mounted to the shield portion 52 as the dotted lines in fig. 9 show. The tinted shield 58 is an integral part of shield  
20 portion 52; if the shield portion 52 is raised or lowered, the tinted shield will follow the motion. The tinted shield 58 is provided to protect the eyes of the wearer from sun rays or reflexions. The tinted shield 58, in the closed position, is hidden away inside upper chamber 56. To lower the tinted shield 58, the

wearer simply has to grip the lever 60 and pull it downward in order for the tinted shield 58 to come over the eyes of the wearer as shown by the dash-dot-dash arrows of figs. 9 and 10. The tinted shield 58 comes down inside the full face helmet 10 providing an excellent protection against sun rays. The tinted shield 58 thereby allows an practical adjustment means for eyes protection against sun rays or bright reflexions. Because it is never in contact with the exterior elements, the tinted shield 58 is protected and remains almost always clean and free of scratches.

10 Referring back to fig. 1 and 2, the full face helmet 10 also includes an air entry 63 located at the front of the face portion 14 that can be controlled by a gate 64 to permit or restrict air flow into the inside chamber 20 of the full face helmet 10. Another air passage 65 is provided at the back of the full face helmet 10 also featuring a gate 66 to permit or restrict air flow into the full face helmet 15 10.

The above description of preferred embodiments should not be interpreted in a limiting manner since other variations, modifications and refinements are possible within the spirit and scope of the present invention. The scope of the 20 invention is defined in the appended claims and their equivalents.

**CLAIMS:**

1. A breathing mask adapted to fit the contours of the face of a wearer, said  
5 breathing mask adapted to be mounted to a helmet, said breathing mask  
comprising at least one breathing channel through which air may circulate  
and a binding member; said at least one breathing channel adaptable to said  
helmet and said binding member adapted to connect and secure said  
breathing mask to said helmet, and to position said breathing mask in  
10 relation to said face.
2. A breathing mask as defined in claim 1, wherein said at least one breathing  
channel comprises a hollow tube connected to at least one port of a mask  
body whereby the breath of a wearer may be expelled from said mask body  
15 and fresh air may enter said mask body.
3. A breathing mask as defined in claims 2, wherein said hollow tube is  
connected to said binding member thereby maintaining said hollow tube in  
a predetermined position in relation to said helmet.  
20
4. A breathing mask as defined in claim 3, wherein said hollow tube includes a  
lip surrounding an exterior end of said hollow tube, said lip adapted to  
hermetically connect said hollow tube to a passage on said helmet.

5. A breathing mask as defined in claim 4, wherein said hollow tube is flexible.
6. A breathing mask as defined in claim 1, further comprising at least one strap connecting said binding member to said breathing mask, said at least one  
5 strap adapted to adjust the position of said breathing mask in relation to said face and to said helmet.
7. A breathing mask as defined in claims 6, wherein said at least one strap is adapted to adjust the length of said hollow tube between said at least one  
10 port of said mask body and said binding member.
8. A breathing mask as defined in any one of the preceding claims, wherein said breathing mask is adapted to receive a filter to be positioned between said breathing mask and the face of said wearer whereby said filter isolates  
15 the skin of said wearer from said breathing mask.
9. A filter for a breathing mask comprising a thin layer of material adapted to isolates the skin of a wearer from said breathing mask, said layer of material shaped to fit a given contour of said breathing mask.  
20
10. A filter for a breathing mask as defined in claim 10, wherein said filter is a thin layer of material adapted to cover the mouth and nose of said wearer.

11. A filter for a breathing mask as defined in claims 9 or 10 further comprising an opening adapted to surround the nose of said wearer.
- 5 12. A filter for a breathing mask as defined in any one of claims 9, 10 and 11, wherein said material is a cloth-like material.
13. A filter for a breathing mask as defined in any one of claims 9, 10 and 11, wherein said material is a felt-like material.
- 10 14. A breathing mask kit comprising:
- a mask body adapted to fit the contours of the face of a wearer, said mask body including at least one port;
  - at least one hollow flexible tube including an interior end and an exterior end;
  - 15 - a binding member including an aperture; said binding member adapted to secure said breathing mask to a helmet and to align said aperture with a passage on said helmet;
  - said interior end being adapted to engage said at least one port of said mask body and said exterior end being adapted to engage said aperture of said binding member whereby when said at least one hollow flexible tube is engaged to said at least one port of said mask body and to said aperture of said binding member, said at least one hollow flexible tube
  - 20

acts as a conduit through which the breath of a wearer may circulate.

15. A breathing mask kit as defined in claim 14, further comprising at least one resilient strap adapted to adjust the length of said hollow flexible tube.

16. A breathing mask kit as defined in claim 15, wherein said exterior end of said hollow flexible tube includes a lip surrounding said exterior end, said lip adapted to hermetically connect said hollow flexible tube to said passage on said helmet.

17. A breathing mask kit for a full-face helmet as defined in any one of claims 14 to 16, further comprising a filter adapted to be positioned between said mask body and the face of said wearer whereby said filter isolates the skin of said wearer from said breathing mask.

18. A helmet adapted to receive and retain a breathing mask as defined in any one of claims 1 to 13.

20

19. A helmet as defined in claim 18, further comprising:  
- a head portion;  
- a face portion mounted to said head portion, said face portion including

at least one passage adapted to receive an exterior end of said breathing channel,

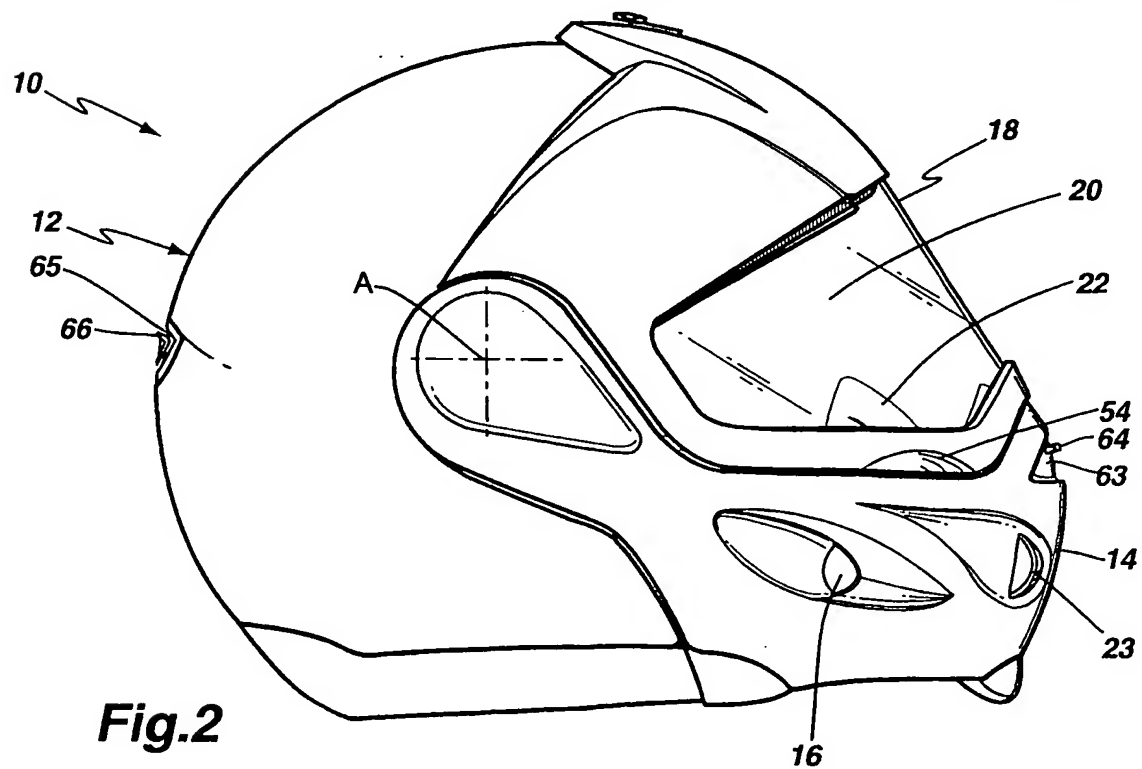
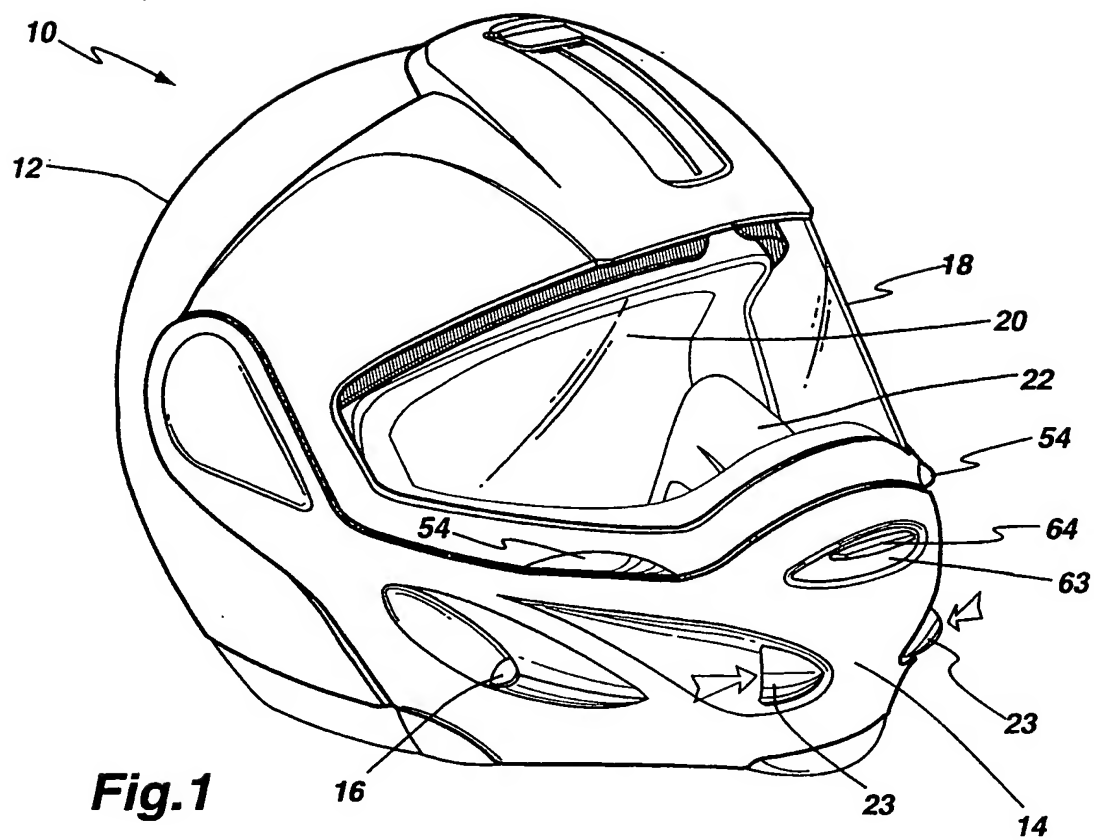
-a binding member adapted to secure said breathing mask to said helmet, whereby the breathing mask is substantially hermetically adapted to the face of the wearer and the breath of the wearer may be expelled from inside said face portion.

20. A helmet as defined in claim 19, wherein said face portion is movable in relation to said head portion from an open position to a closed position and wherein an inside chamber is defined by said head portion and said face portion and said shield portion when said face portion is in the closed position.

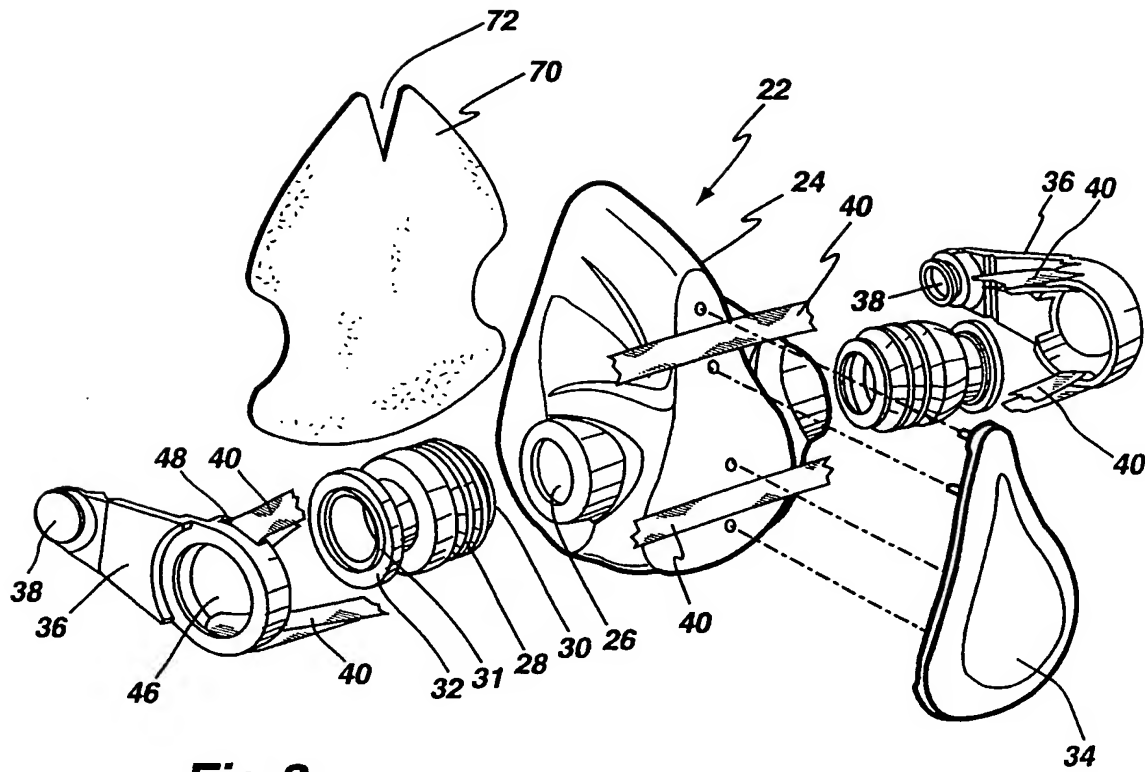
21. A helmet as defined in any one of claims 18 to 20, wherein said face portion further comprises a shield portion including a see-through shield, said shield portion adapted to move in relation to said head portion and said face portion from an open position to a closed position.

22. A helmet as defined in any one of claims 18 to 21, further comprising a tinted shield, said tinted shield being movable from a first position to a second position, said tinted shield adapted, in said first position, to be housed and partially hidden inside an upper chamber, and in said second position, to be in front of the eyes of the wearer.

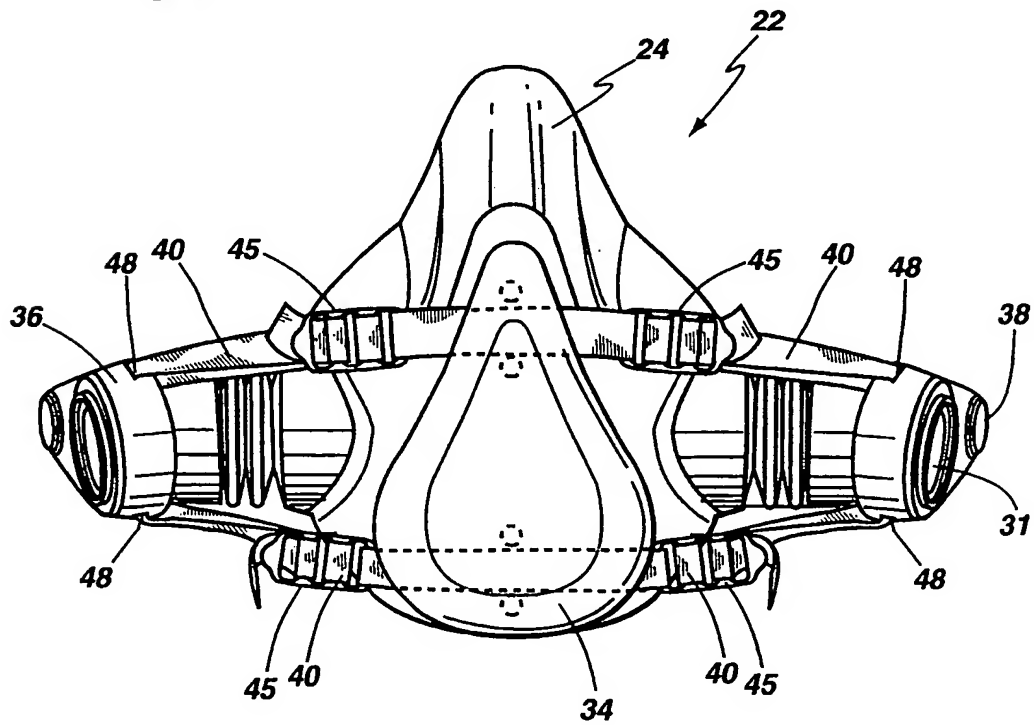
23. A helmet as defined in claim 22, wherein said tinted shield includes a lever protruding from a narrow slot of said upper chamber, said lever adapted to manoeuver said tinted shield from said first position to said second position.
24. A helmet as defined in any one of claims 18 to 22, further comprising a filter adapted to be positioned between said breathing mask and the face of a wearer.
25. A helmet as defined in any one of claims 21 to 24, wherein said face portion includes a latching mechanism that locks said face portion onto said head portion when said face portion is in said closed position.
26. A helmet as defined in claim 25, wherein said latching mechanism is actuated by a pair of lever buttons, said lever buttons being positioned on said face portion in a manner whereby they may be actuated with a single hand.
27. A helmet as defined in any one of claims 18 to 26, further comprising a filter adapted to be positioned between said breathing mask and the face of a wearer.



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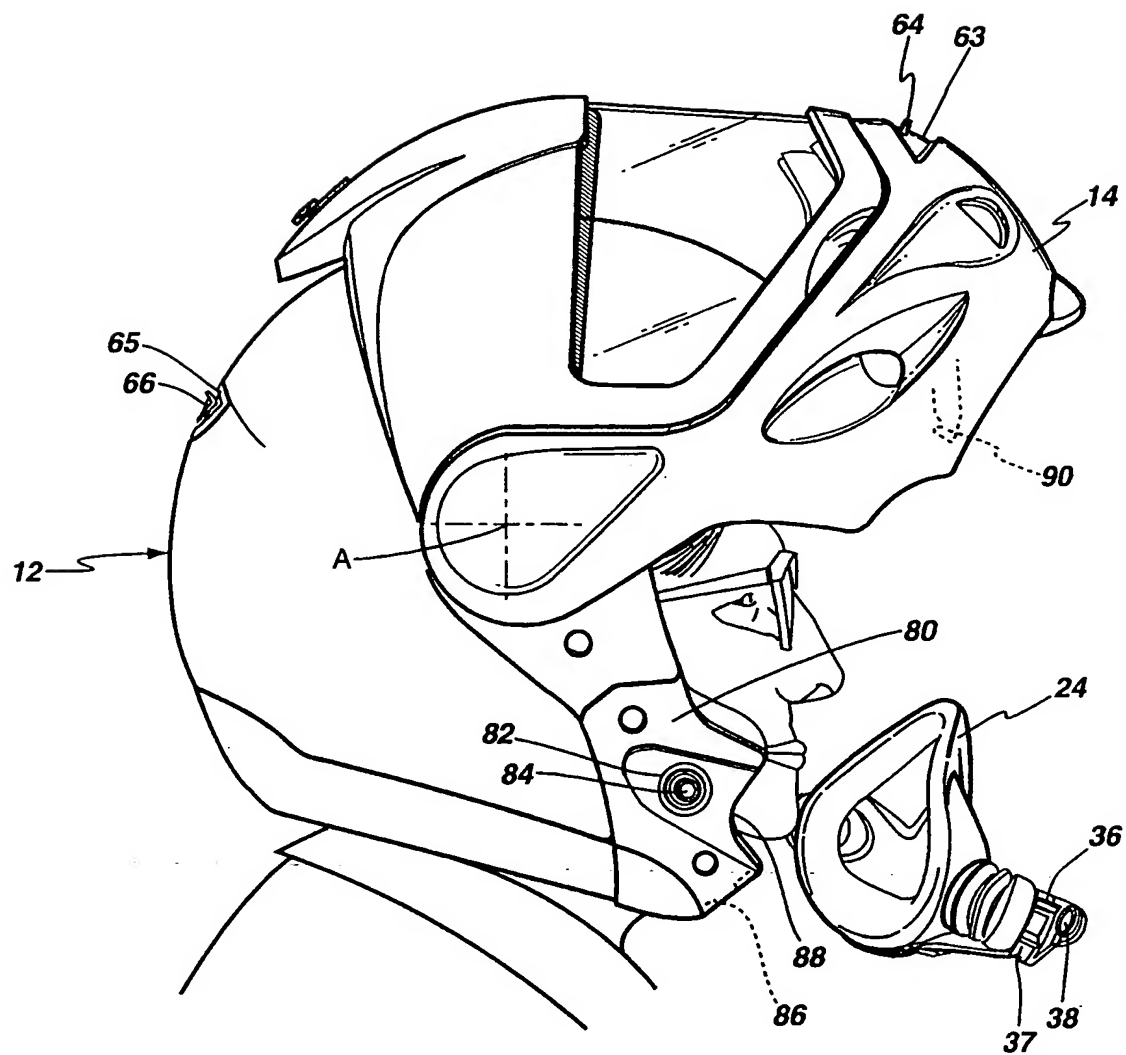


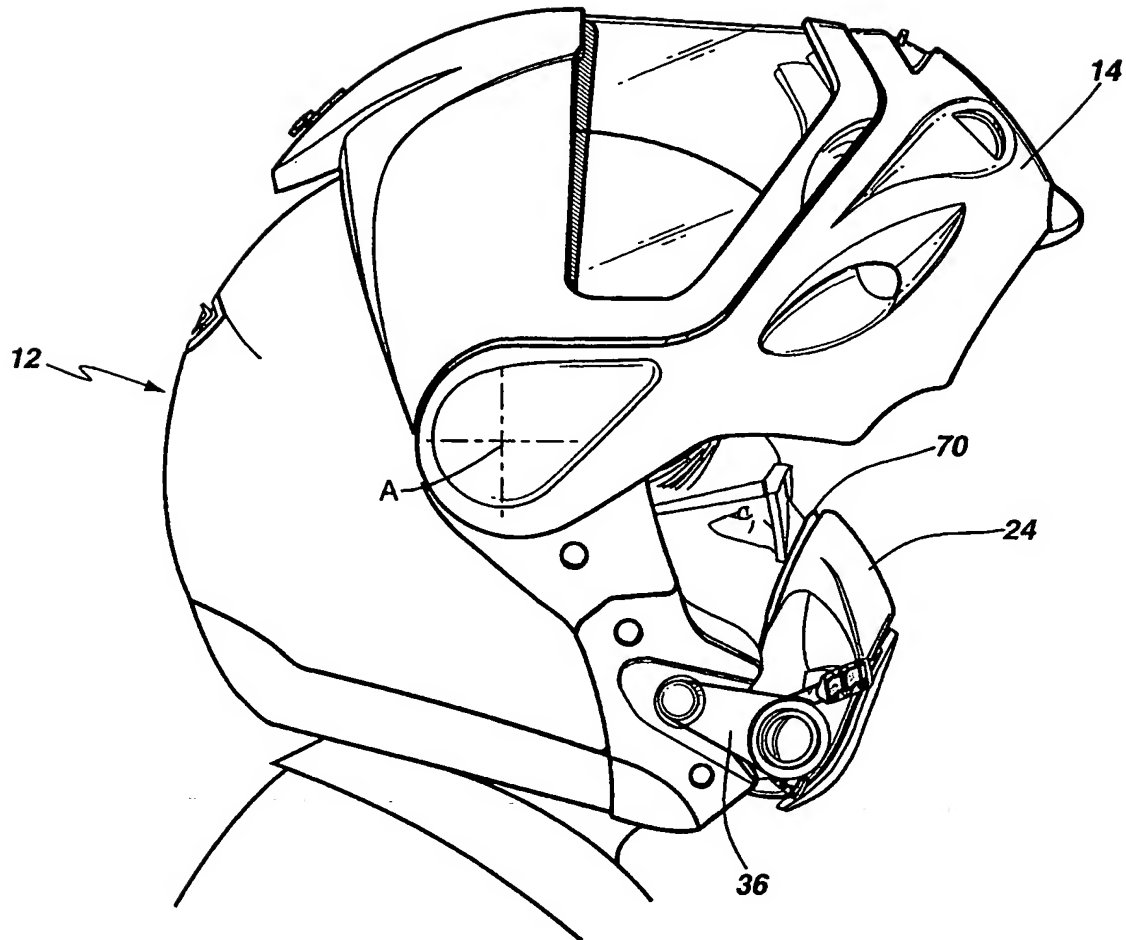
**Fig.3**



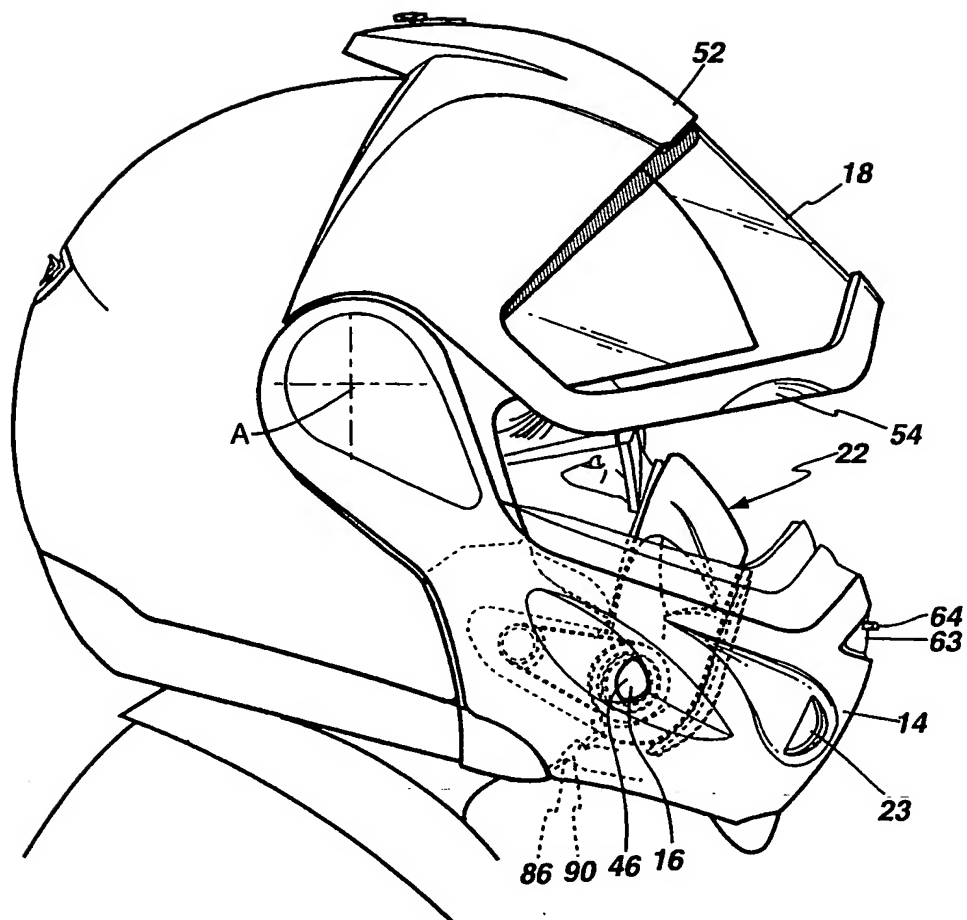
**Fig.4**

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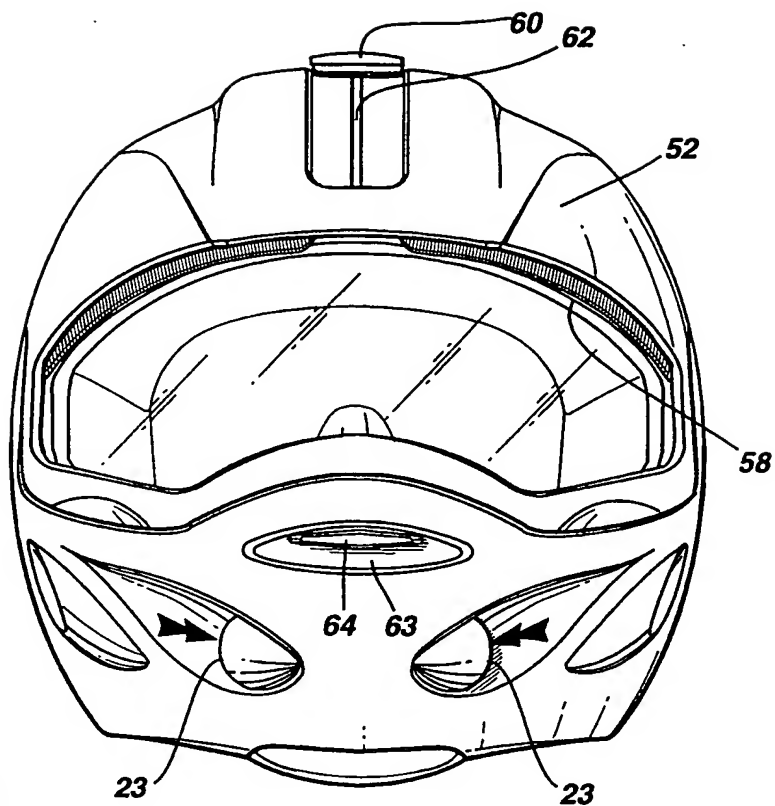
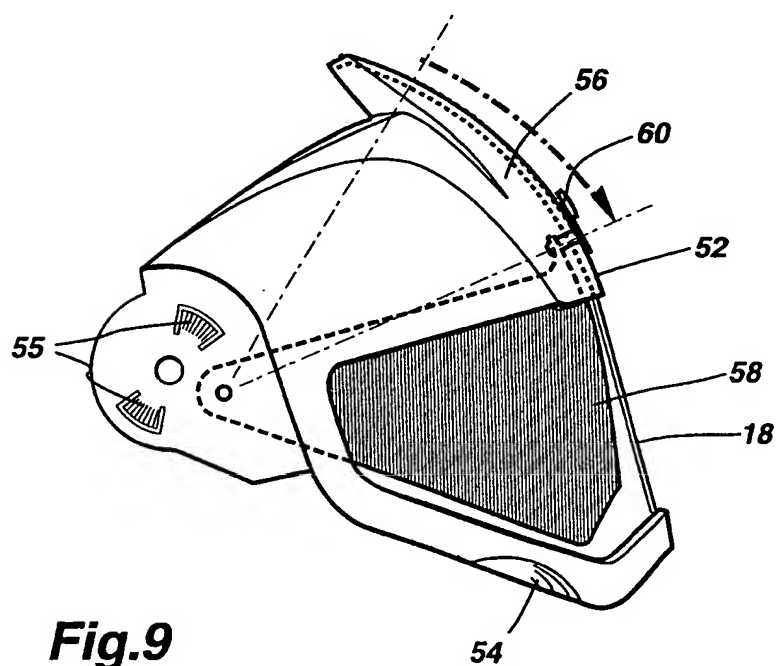
**Fig.5**



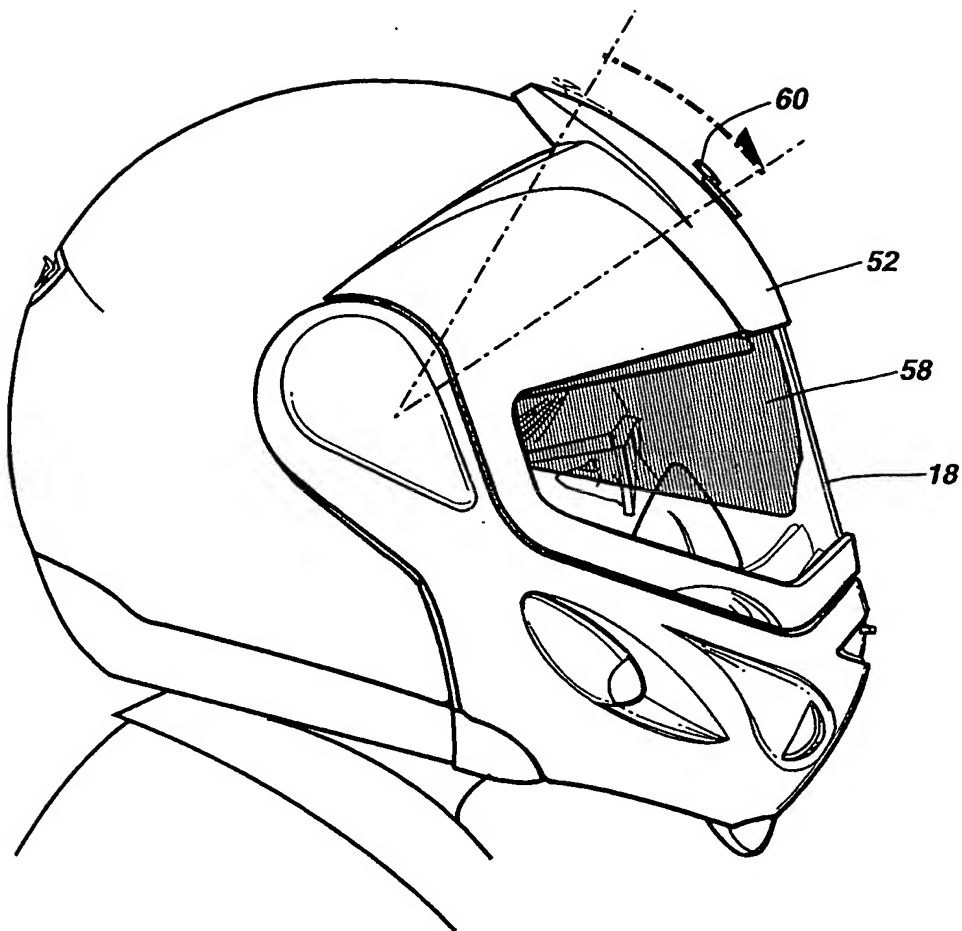
**Fig.6**

**Fig.7**

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**Fig.8****Fig.9**

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**Fig.10**

# INTERNATIONAL SEARCH REPORT

International Application No

PCT/CA 98/01126

**A. CLASSIFICATION OF SUBJECT MATTER**  
IPC 6 A62B18/04 A62B18/08

According to International Patent Classification (IPC) or to both national classification and IPC

## B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC 6 A62B H04R A42B

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

## C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 5 515 843 A (CHANG) 14 May 1996 see column 2, line 11 - column 3, line 8; figures	1-27
A	EP 0 371 858 A (INTERTECHNIQUE) 6 June 1990 see column 3, line 2 - column 5, line 51; figures	1-27
A	US 4 315 335 A (KENNEDY JR) 16 February 1982 see column 2, line 23 - column 3, line 16; figures	1-27

☐ Further documents are listed in the continuation of box C.

☒ Patent family members are listed in annex.

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Date of the actual completion of the international search

16 March 1999

Date of mailing of the international search report

25/03/1999

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# INTERNATIONAL SEARCH REPORT

information on patent family members

International Application No

PCT/CA 98/01126

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 5515843 A	14-05-1996	NONE	
EP 371858 A	06-06-1990	FR 2639545 A	01-06-1990
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